MARKET TIMING: STYLE (VALUE VERSUS GROWTH) AND SIZE ROTATION USING THE MVX

by

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Abstract

This paper analyzes the possibility of using MVX (Montreal Exchange – MX Implied Volatility Index)[i] the implied volatility of the Canadian market as a leading indicator in the design and execution of long-short trading strategy. We consider the sample 1809 daily data from March 20, 2003 to May 28, 2010.

Prior studies finds Market Volatility Index (VIX)[ii] of the Chicago Board Options Exchange a leading indicator of daily market returns and it indicates that market timing may be feasible. We are extending the work done on market timing and timing the return by using the Canadian counterpart, MVX and stocks from the Toronto Stock Exchange (S&P/TSX Composite Index)[iii]

We examined the possibility of two trading strategies for Canadian market:

Strategy one is switching between value and growth portfolios. The strategy involves taking a long position in value portfolio and a short position in growth portfolio when volatility increases and vice versa when volatility decreases.

Strategy two is switching between stocks of companies with different market capital (size). The strategy involves taking a long position in large portfolio and a short position in small portfolio when volatility increases and when volatility decreases the opposite will be executed.

Using similar methods from Copeland and Copeland (1999), we have a slightly different result which is expected since we are using the Canadian financial system instead of the American financial system. The findings from Copeland and Copeland (1999) are that VIX is a valid indicator and positive excess returns in both directions. The value and large cap outperform its peers when volatility increases. When volatility decreases then small-cap and growth stocks outperform their peers. In other words, both trading strategy of rotating between style and size was affective in the American market.

The results of our research show that in the Canadian market, MVX is only a good timing indicator for the rotating using style strategy. We didn't obtain explainable or robust results from the rotating using size strategy.

To my beloved parents Farideh and Zia, my brother Mehdi, and my sister Mahsa who have supported me all my life.

Reza

To my beloved family and friends who have supported my through the varies up and downs of my life. Enjoy this research. As well, to my dear professor at SFU who have made my time here the most memorable.

Jerry Su

Special Thanks to our dear professor Christina Atanasova

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1: Literature review

Our trading strategy is devised through many of the academic researches done on investing in commonalities in stock indexes. This section is to give a development history of how the idea of trading using volatility between the style and size portfolio came to be. Chan and Chen (1991) researched to identify structural and return characteristics with small companies along with Fama and French (1993) who developed the theory based on size and value premium. All these researches helped us shape the way we constructed our portfolios. There are counter arguments that we have thought about as well while writing the article. Lakonishoket al. (1994) and Haugen and Baker (1996) attributes the effects by other researchers are due to the market's inability to price efficiently. Mertons (1980) gave us the insight that maybe in times of capital market equilibrium, where the assumption that majority investors have constant relative risk aversion. The market risk premium is positively related to the market portfolio. Copeland and Copeland (1999) combined these ideas and came up with the trading strategy that we use for the proceeding research. There are many different methods of forecasting volatility in various classes. Nelson (1991) helped us to eliminate using the GARCH method as an estimator because it found negative correlation between current returns and future returns volatility. Fleming, Ostdiek and Whaley (1995) finding on VIX provided stronger results for using VIX as a implied volatility indicator. For comparison purposes, we have looked up some similar trading strategies done in the academic world in other countries. Levis and Liodakis (1999) attempted to find profitability of size and value/growth rotation strategies in the United Kingdom. Their findings provide strong support for the trading strategy based on size but not on style, which is complete opposite to our finding for the Canadian market. As well, Bauer, Derwall and Molenaar (2004) completed a similar research exploring whether or not size and value premium is predictable through a timing strategy in Japan. The results of their study is that there is sufficient predictability under low transaction cost levels while is it difficult when transaction costs are high.

2: Timing and Trading Strategies

The MVX is a reflection of market's expectation of the relative volatility of the stock market in the next month. MVX is derived from at-the money-options of the Canadian S&P/TSX 60 fund. According to French, Schwert and Stambaugh (1987), when market volatility increases unexpectedly, predicted volatility will increase and the future discount rate will go up. This will bring down the stock price assuming that cash flow is not affected. Following of Merton (1980) and French, Schwert and Stambaugh (1987) findings, Copeland, Copeland (1999) designed two trading strategies based on the VIX and six different size and style portfolios.

Strategy one is switching between value and growth portfolios. If the estimate of expected future volatility increases, the strategy involves taking a long position in value portfolios and a short position in growth portfolios and vice versa when volatility decreases, because when the volatility is high, the predictability of future cash flow falls. Value stocks are stocks whose prices not driven from companies with high future growth and cash flow. We expect investing in value stocks helps with capital preservation when volatility is high and whenever the MVX is low, the growth portfolios should outperform the value portfolios.

Strategy two is switching between stocks of companies with different market capital (size). Small-cap returns are generally higher than large capital. Fama and French 1992, and Copeland and Copeland 1999 show that the above is especially true when the volatility is low since volatility and market return are negatively correlated. The securities that have a higher beta should underperform when volatility increases.

We discuss the possibility of using different measures of expected volatility as a signal for trading strategies.

2.1 Estimating Expected Volatility

Generally, studies have used high and low prices, close-to-close prices, GARCH [iv] and EGARCH [v] to model and measure the volatility. The two methods that we are going to discuss are GARCH and Implied Volatility (MVX).

GARCH (p,q) where p is the order of the GARCH terms σ^2 and q is the order of the ARCH terms ε^2 could be used as a good historical measure of volatility.

Implied Volatility represents the volatility built into the price of an option in the market. Implied volatility is particularly important because it determines market consensus about the expected volatility of the underlying stock in the future.

MVX is a good proxy of investor sentiment for the Canadian equity market: the higher the Index, the higher the risk of market turmoil. A rising Index therefore reflects the heightened fears of investors for the coming month. MVX also gives an indication of whether options are relatively cheap or expensive, as the higher the implied volatility, the higher options premiums become. MVX is a forward-looking forecast of market volatility and it always gives a one month forecast horizon.

Figure 1 shows the historical chart of MVX from March 20, 2003 to May 28, 2010.

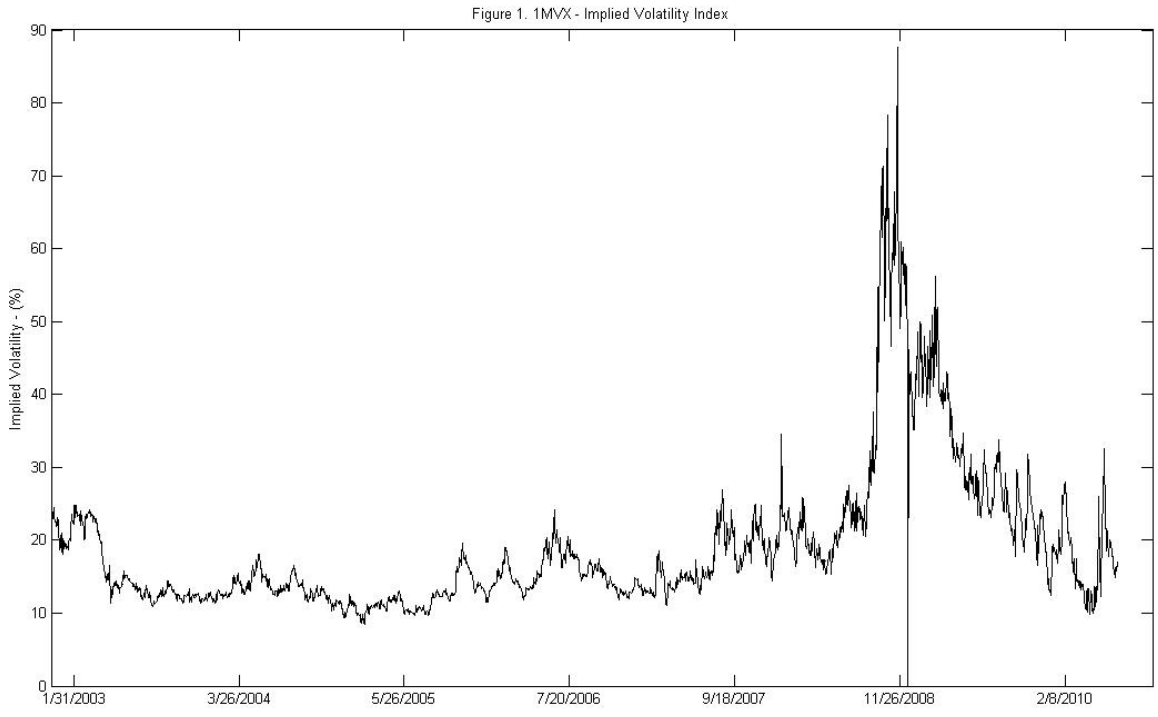


Figure 2 indicates the daily percentage changes of MVX from March 20, 2003 to May 28, 2010.

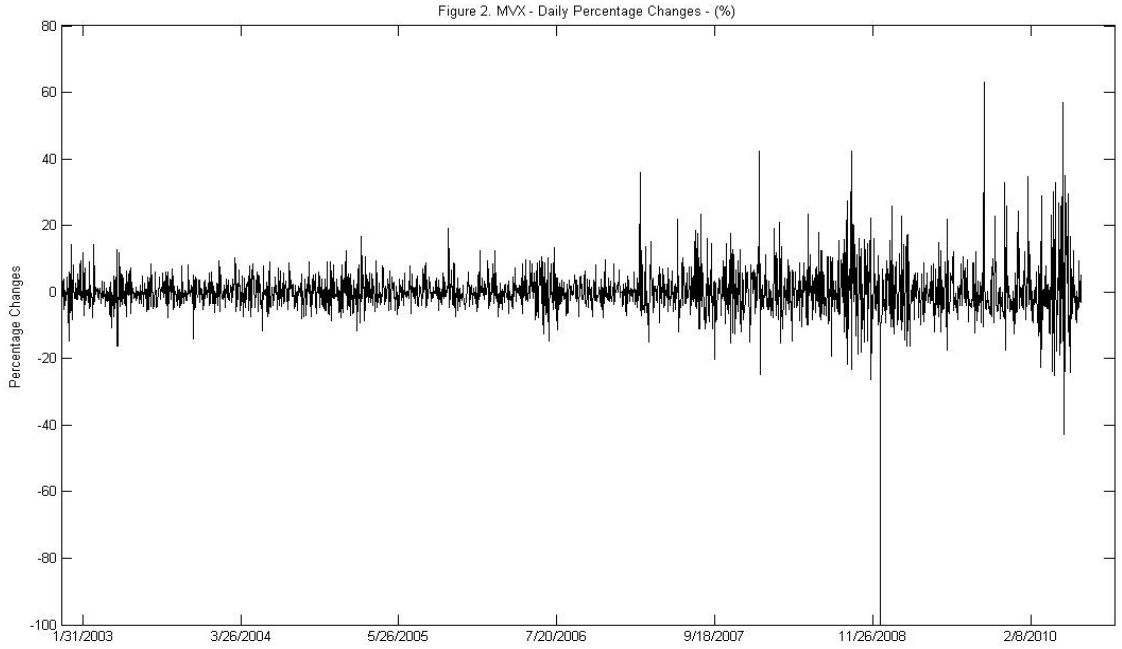
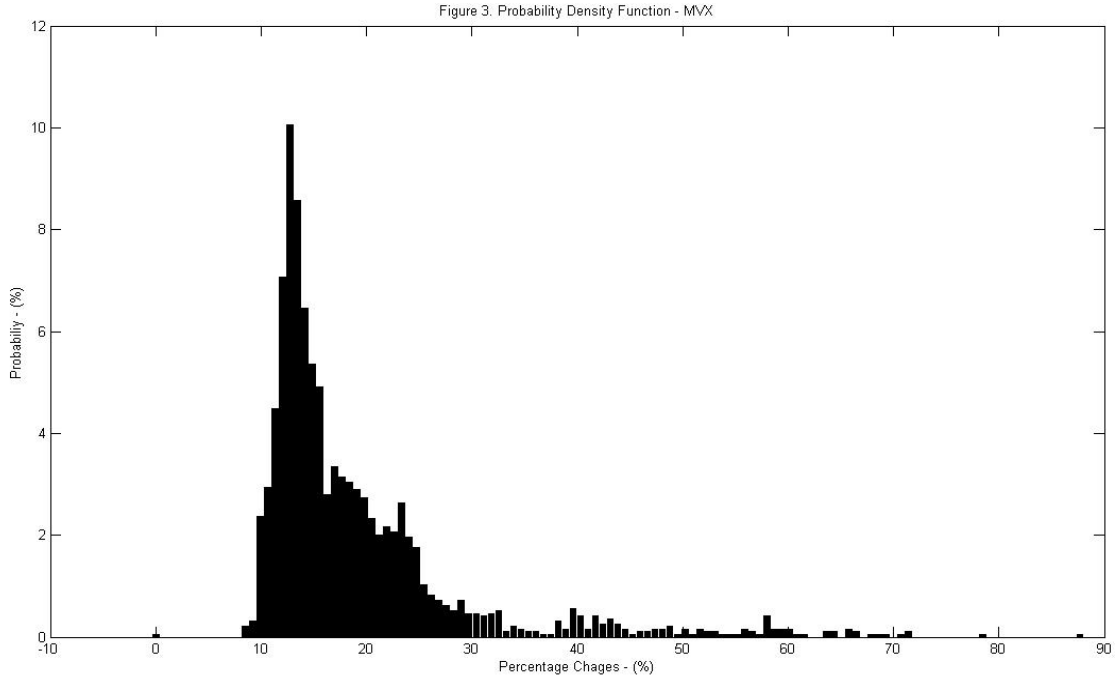


Figure 3 indicates the probability density function of MVX from March 20, 2003 to May 28, 2010.



GARCH model could be used for forecasting the volatility of market. GARCH model is not very stable and underestimates future volatility (Nelson (1991)) while the implied volatility is a forward-looking measurement of risk. In our project we are attempting to predict the future outcomes, we will be using the implied volatility of risk.

We discuss the possibility of timing based on style and size in the following sections. We start with timing based on style.

3: Timing Based on Style (Value versus Growth)

To run the regression to seek out the relationships between changes in volatility and the six portfolios, we must first define the portfolios. There are going to be a total of six portfolios and they will be large-cap/growth, mid-cap/growth, small-cap/growth, large-cap/value, mid-cap/value, small-cap/ value. Key variables used to determine the value and growth portfolios are sales growth per share and book value per share[vi]. As previously mentioned, the selected stocks come from the S&P/TSX Composite Index and the observations were made based on 90 monthly data between January 2003 and June 2010.

We categorized stocks based on market capital in three groups of more than 10 billion dollar market capital as large which includes 35 stocks, between 10 and 2 billion dollar market capital as medium which includes 64 stocks, and less than 2 billion dollar capital as small capital which includes 74 stocks. Then for style (Growth versus Value) we categorized each portfolio based on book value per share. For size (Large versus Small) we categorized each portfolio based on sales growth per share. Any other stocks which were not available starting 2003 were deleted.

Below are the exact selection criteria we used for the portfolios.

- Large-Cap/Growth: Based on top 40th percentile of stocks in SP/TSX sorted based on Sales growth per share with 10 billion dollar market capital or more including 14 stocks.
- Large-Cap/Value: Based on top 40th percentile of stocks in SP/TSX sorted based on book value per share with 10 billion dollar market capital or more including 14 stocks.

The average percentile for large portfolios is 40 of stocks in SP/TSX with 10 billion dollar market capital or more based on Sales Growth per Share or Book Value per Share.

- Medium-Cap/Growth: Based on top 27th percentile of stocks in SP/TSX sorted based on Sales growth per share with 2 billion to 10 billion dollar market capital including 17 stocks.
- Medium-Cap/Value: Based on top 30th percentile of stocks in SP/TSX sorted based on book value per share with 2 billion to 10 billion dollar market capital including 19 stocks.

The average percentile for medium portfolios is 28 of stocks in SP/TSX with 2 billion to 10 billion dollar market capital based on Sales Growth per Share or Book Value per Share.

- Small-Cap/Growth: Based on top 12th percentile of stocks in SP/TSX sorted based on Sales growth per share with less than 2 billion dollar market capital including 9 stocks.
- Small-Cap/Value: Based on top 20th percentile of stocks in SP/TSX sorted based on book value per share with less than 2 billion dollar market capital including 15 stocks.

The average percentile for small portfolios is 16 of stocks in SP/TSX with less than 2 billion dollar market capital based on Sales Growth per Share or Book Value per Share.

3.1 Contemporaneous relationship between change in Historical Volatility and the index return

Table 1 shows a contemporaneous Relationship between Change in Historical Volatility and Index Return based on 90 monthly observations between January 2003 and June 2010. Regressions confirmed negative correlation for all indices.

Table 1. Contemporaneous Relationship between Change in Historical Volatility and Index Return

Regression of the logarithmic return on portfolio versus the percentage changes in historical volatility.

Index	Intercept	T-Statistics	Slope	T-Statistics	R^2
Large/Growth	0.0158	2.6271	-0.1655	-5.7175	0.2709
Large/Value	0.0065	2.0615	-0.1042	-6.8964	0.3508
Medium/Growth	0.0193	3.3082	-0.1716	-6.1308	0.2993
Medium/Value	0.0105	2.5461	-0.1062	-5.3830	0.2477
Small/Growth	0.0142	1.9386	-0.1751	-4.9762	0.2196
Small/Value	0.0045	1.0885	-0.1109	-5.5600	0.2600
Large Cap	0.0103	2.9011	-0.1299	-7.6246	0.3978
Small Cap	0.0063	1.5935	-0.1366	-7.1673	0.3686
SP/TSX	0.0091	2.9174	-0.1254	-8.3476	0.4419
SP/TSX 60	0.0094	2.8158	-0.1327	-8.2606	0.4368

Note: Based on 90 monthly observations between January 2003 and June 2010.

The absolute value of slopes for Large/Growth is higher than Large/Value (-0.1655 versus -0.1042), the absolute value of slopes for Medium/Growth is higher than Medium/Value (-0.1716 versus -0.1062) and the absolute value of slopes for Small/Growth is higher than Small/Value (-0.1751 versus -0.1109). The regressions confirm our expectation about the negative correlation between volatility and return in the market. . The absolute values of slopes

for value portfolios are smaller than growth portfolios. If the relationship remains stable, timing based on style rotation for value to growth and vice versa should be possible. The absolute values of slopes for large-cap portfolios are smaller than Small-cap portfolios. If the relationship remains stable, timing based on size rotation is possible.

3.2 Contemporaneous relationship between timing and style

Table 2 shows Contemporaneous relationship between timing and style based on 90 monthly observations between January 2003 and June 2010 based on the following regression:

$$_{(1)}\ R_{value,t} - R_{growth,t} = \alpha + \beta . Volatility_{k,t} + \varepsilon_t$$

$R_{value,t}$ = logarithmic return on value portfolio (large,medium,small) at time t

$R_{growth,t}$ = logarithmic return on growth portfolio (large,medium,small) at time t

$Volatility_{k,t}$ = the level,change in level, or percentage change in historical volatility at time t

α = intercept

β = slope

ε_t = normally distributed error term at time t

Table 2. Contemporaneous Relationship between Timing and Style

Variables	Intercept	T-Statistics	Slope	T-Statistics	R^2
Level of historical volatility					
Large/Value minus Large/Growth	-0.0342	-2.5854	0.0014	2.2050	0.0524
Medium/Value minus Medium/Growth	-0.0234	-1.8830	0.0009	1.4308	0.0227
Small/Value minus Small/Growth	-0.0253	-1.7757	0.0009	1.3274	0.0196
Change in level of historical volatility					
Large/Value minus Large/Growth	-0.0082	-1.3849	0.0033	2.4875	0.0657
Medium/Value minus Medium/Growth	-0.0076	-1.3844	0.0031	2.5588	0.0693
Small/Value minus Small/Growth	-0.0085	-1.3688	0.0041	2.9542	0.0902
Percentage change in historical volatility					
Large/Value minus Large/Growth	-0.0094	-1.5639	0.0613	2.1357	0.0493
Medium/Value minus Medium/Growth	-0.0088	-1.6043	0.0653	2.4761	0.0651
Small/Value minus Small/Growth	-0.0097	-1.5253	0.0641	2.1047	0.0479

Note: Based on 90 monthly observations for value and growth portfolios between observations between January 2003 and June 2010.

The t-statistics for regressions based on percentage change in historical volatility are all significant. We are more focused on regressions based on percentage change in historical volatility since we used that for all regressions for other tables.

3.3 Estimation results based on timing and style

Having a fairly high t-statistics from both table 1 and table 2 demonstrates that there is a statistically significant relationship between historical volatility and the style portfolio. The t-statistics are mostly significant at the ninety-five percent confidence interval. From the slope of table 2 it demonstrates that the returns from value portfolio exceeds growth portfolio when historical volatility increases.

When we use the daily MVX, there is too much noise. Copeland and Copeland (1999) suggests the usage of the percentage change in the MVX (the spread between today's MVX and the 75-day historical moving average divided by the 75-day historical moving average).

Table 3.1 shows the results of the regression of the returns on Value minus Growth portfolio bought and held for 1 to 20 days versus the percentage change in the MVX from the period of March 20th 2003 to May 28th 2010. For this time period, the t-statistics are not significant enough and we think it is mainly due to the financial crisis that we were just in. We divided the data into two time periods instead and the results are shown on table 3.2 and 3.3.

Table 3.2 shows the regression results between March 20th 2003 and October 20th 2006. The results are much more significant for all holding periods as the t-Statistics all exceed the plus and minus 1.96 critical values (the slopes are negative).

Table 3.3 shows the regression results between October 20th 2006 and May 28th 2010. The table shows that in this case the t-Statistics are only significant for holding periods of between 3 and 10 days.

We think the financial crisis distorts the feasibility of our strategies. When only considering the period of March 20th 2003 to October 20th 2006, the results shows potential feasibility of a positive return trading strategy if we use the timing of the MVX to switch between our value and growth portfolios.

Table 3. Value minus Growth Index Returns versus Percentage Change in the MVX Today

Regression of the returns on Value minus Growth portfolio bought and held for 1 to 20 days versus the spread between today's MVX and the 75-day historical moving average divided by the 75-day historical moving average.

Table 3.I

Holding Period (days)	Intercept	T-Statistics	Slope	T-Statistics	R^2
1	0.0001	0.3679	0.0000	-0.0305	0.0000
2	0.0000	0.0999	0.0012	0.5798	0.0002
3	0.0022	3.9434	-0.0087	-3.2223	0.0057
4	0.0003	0.6321	0.0025	0.9578	0.0005
5	0.0006	0.8170	0.0045	1.3471	0.0010
10	0.0011	1.1611	0.0056	1.2349	0.0008
20	0.0022	1.6006	-0.0048	-0.7450	0.0003

Note: Based on 1809 daily rates of return of value and growth indexes for March 20, 2003 to May 28, 2010

Table 3.2

Holding Period (days)	Intercept	T-Statistics	Slope	T-Statistics	R^2
1	0.0001	0.5133	-0.0053	-2.9101	0.0093
2	0.0002	0.4987	-0.0110	-4.1537	0.0187
3	0.0039	6.4810	-0.0108	-2.4772	0.0067
4	0.0004	0.8596	-0.0169	-5.1865	0.0289
5	0.0007	1.1715	-0.0265	-6.2725	0.0418
10	0.0015	1.7880	-0.0460	-7.8316	0.0636
20	0.0028	2.4215	-0.0724	-8.6359	0.0763

Note: Based on 905 daily rates of return of value and growth indexes for March 20, 2003 to October 20 2006

Table 3.3

Holding Period (days)	Intercept	T-Statistics	Slope	T-Statistics	R^2
1	0.0000	0.0702	0.0015	0.6614	0.0005
2	-0.0002	-0.2924	0.0048	1.5374	0.0026
3	0.0005	0.5309	-0.0077	-2.0905	0.0048
4	0.0001	0.0668	0.0080	2.1542	0.0051
5	0.0001	0.0689	0.0133	2.7911	0.0086
10	0.0002	0.0925	0.0205	3.1311	0.0108
20	0.0007	0.3034	0.0146	1.5731	0.0027

Note: Based on 905 daily rates of return of value and growth indexes for October 20, 2006 to May 28, 2010

Similar to Copeland and Copland (1999), we find that when the MVX is X percent greater than its 75-day historical moving average, we will take a long position in our value portfolio and a short position in our growth portfolio and meanwhile we do the opposite when the MVX drops below the X percent. The results of this trading strategy are in table 4.1, 4.2 and 4.3. We again separated the results into the whole period and two sub-periods as previously mentioned. The Holding Periods column shows the number of days a position is kept (position was often maintained from day to day) once it was signaled by a given percentage change of MVX (the second column). Column 3 shows the number of round trip transactions (a buy and a sell).

The results in table 4.1 are based on 1809 daily data for the period March 20th 2003 to May 28th 2010. The trading strategy based on style yields positive returns (the cumulative returns are mostly positive), however because the t-statistics are not significant enough, we cannot conclude that the positive return is a result of our trading.

Table 4.1

Note: Based on 1809 daily rates of return of value minus growth index for March 20, 2003 to May 28, 2010

Holding Period (Days)	Changes in the MVX	Number of Round-Trip Transactions	Cumulative Return	Daily Average Return (Basis Points)
1	10	62	21.35%	5.28
1	20	37	19.50%	9.07
1	30	26	6.67%	5.70
1	40	17	0.08%	0.12
1	-10	72	35.48%	6.73
1	-20	50	13.15%	7.07
2	10	38	24.53%	6.45
2	20	30	16.45%	7.91
2	30	15	1.71%	1.62
2	40	6	-14.25%	-24.15
2	-10	48	42.59%	8.47
2	-20	22	15.33%	9.70
3	10	25	14.00%	4.23
3	20	19	6.93%	3.73
3	30	9	-3.26%	-3.47
3	40	6	-14.25%	-24.15
3	-10	39	40.85%	8.42
3	-20	12	22.99%	16.66
10	10	13	18.01%	6.10
10	20	5	-1.02%	-0.84
10	30	3	-13.04%	-21.73
10	40	2	-10.03%	-25.73
10	-10	13	61.14%	18.25
10	-20	5	18.59%	18.41

Table 4.2 is based on 905 daily data from March 20th 2003 to October 20th 2006. The trading strategy based on style only generates positive return 10 out of 24 times but they are statistically significant. The one consistent result we can obtain from this table is that when the changes in the MVX are 10 or -10% and the holding period is between one and two then the result is always positive. This finding is different from Copeland and Copeland (1999) where they find the most profitable strategy to be using larger changes (20 percent or higher).

Table 4.2

Note: Based on 905 daily rates of return of value minus growth index for March 20, 2003 to October 20 2006

Holding Period (Days)	Changes in the MVX	Number of Round-Trip Transactions	Cumulative Return	Daily Average Return (Basis Points)
1	10	23	3.17%	1.92
1	20	13	-9.19%	-13.72
1	30	6	-10.22%	-34.07
1	40	4	-5.91%	-73.90
1	-10	31	28.71%	14.96
1	-20	10	18.91%	41.11
2	10	13	0.72%	0.47
2	20	10	-10.41%	-16.27
2	30	5	-10.24%	-35.32
2	40	2	-4.73%	-78.90
2	-10	19	28.72%	15.96
2	-20	4	18.69%	46.72
3	10	10	-1.83%	-1.23
3	20	6	-10.21%	-18.24
3	30	2	-8.30%	-36.11
3	40	2	-4.73%	-78.90
3	-10	14	29.36%	17.27
3	-20	1	17.19%	50.56
10	10	6	-7.48%	-5.67
10	20	2	-10.96%	-0.003
10	30	1	-5.19%	-28.86
10	40	0	0.00%	0.00
10	-10	5	27.68%	24.71
10	-20	1	17.19%	50.56

Table 4.3 is based on 905 daily data from October 20th 2006 to May 28th 2010. For the holding period of three days for the changes in MVX of 10% to 30% and for -10% and -20% the strategy has significant positive results. For the holding period of ten days for the changes in MVX of 10% to 20% and for -10% and -20% the strategy has significant positive results.

Table 4.3

Note: Based on 905 daily rates of return of value minus growth index for October 20, 2006 to May 28, 2010

Holding Period (Days)	Changes in the MVX	Number of Round-Trip Transactions	Cumulative Return	Daily Average Return (Basis Points)
1	10	39	17.39%	7.63
1	20	22	25.96%	18.28
1	30	19	16.31%	18.97
1	40	13	6.00%	9.67
1	-10	41	6.76%	2.02
1	-20	40	-5.76%	-4.11
2	10	25	23.02%	10.76
2	20	18	24.12%	17.48
2	30	10	11.95%	15.53
2	40	4	-9.52%	-17.96
2	-10	29	13.86%	4.29
2	-20	18	-3.36%	-2.84
3	10	15	16.03%	8.26
3	20	11	14.41%	11.62
3	30	7	5.05%	7.11
3	40	4	-9.52%	-17.96
3	-10	25	11.49%	3.62
3	-20	11	5.80%	5.57
10	10	7	24.70%	16.25
10	20	3	9.94%	11.29
10	30	2	-7.85%	-18.68
10	40	2	-10.03%	-25.73
10	-10	8	33.46%	15.00
10	-20	4	1.40%	2.09

In the next section we discuss the possibility of timing based on size.

4: Timing Based on Size

4.1 Contemporaneous relationship between Timing and Size

(2) $R_{Large,t} - R_{small,t} = \alpha + \beta.Volatility_{k,t} + \varepsilon_t$

$R_{Large,t}$ = logarithmic return on large portfolio at time t

$R_{Small,t}$ = logarithmic return on small portfolio at time t

$Volatility_{k,t}$ = the level,change in level, or percentage change in historical volatility at time t

α = intercept

β = slope

ε_t = normally distributed error term at time t

Table 5 shows the contemporaneous relationship between timing and size based on Equation 2. The regressions are based on 90 daily data between January 2003 and June 2010. Although the results show positive slopes the t-statistics are not significant. So the betas are not significantly

Table 5. Contemporaneous Relationship between Timing and Size

Variables	Intercept	T-Statistics	Slope	T-Statistics	R^2
Level of historical volatility					
Large minus Small	-0.0036	-0.5935	0.0004	1.4022	0.0219
Change in level of historical volatility					
Large minus Small	0.0039	1.4565	0.0006	1.0350	0.0120
Percentage change in historical volatility					
Large minus Small	0.0038	1.4020	0.0060	0.4557	0.0024

Note: Based on 90 monthly observations for large and small portfolios between observations between January 2003 and June 2010.

different from zero. Therefore the possibility of timing based on size is not feasible against the MVX.

4.2 Estimation results based on timing and size

In table 6, we will use the alternative method of which we run the regression against the spread of the MVX instead.

A regression is run against the percentage change in today's MVX and the returns on the large-cap minus small-cap portfolios. As previously done, we have split it into two sub-periods. Please refer to table 6.1, 6.2, and 6.3.

Table 6.1 shows the results of a regression of the returns on Large minus Small portfolio bought and held for 1 to 20 days versus the percentage change in the MVX from the period of March 20th 2003 to May 28th 2010. For this time period, the t-statistics are significant for the most part except for the 10 Day holding and beyond.

To verify the result, we broke down the time period again into before financial crisis and after financial crisis to see if there is any consistency. Table 6.2 shows the regression results between March 20th 2003 and October 20th 2006. The results are not significant except for holding periods 10 days to 20 days.

Table 6.3 shows the regression results between October 20th 2006 and May 28th 2010. As you can see in this case the t-statistics are not significant at all based on 95% of confidence interval.

Table 6. Large minus small Index Returns versus Percentage Change in the MVX Today

Regression of the returns on Large minus Small portfolio bought and held for 1 to 20 days versus the spread between today's MVX and the 75-day historical moving average divided by the 75-day historical moving average.

Table 6.I

Holding Period (days)	Intercept	T-Statistics	Slope	T-Statistics	R^2
1	0.0008	1.6953	0.0043	1.9591	0.0021
2	0.0015	2.5021	0.0062	2.2152	0.0027
3	0.0022	3.2159	0.0064	1.9644	0.0021
4	0.0029	3.8071	0.0064	1.7474	0.0017
5	0.0015	2.5021	0.0062	2.2152	0.0027
10	0.0071	6.6389	0.0008	0.1641	0.0000
20	0.0141	9.9975	0.0045	0.6654	0.0002

Note: Based on 1809 daily rates of return of large minus small index for March 20, 2003 to May 28, 2010

Table 6.2

Holding Period (days)	Intercept	T-Statistics	Slope	T-Statistics	R^2
1	0.0013	2.7290	0.0032	0.9373	0.0010
2	0.0026	4.0191	0.0075	1.6125	0.0029
3	0.0039	5.1298	0.0094	1.7137	0.0032
4	0.0052	6.0619	0.0113	1.8162	0.0036
5	0.0026	4.0191	0.0075	1.6125	0.0029
10	0.0133	10.8290	0.0324	3.6368	0.0144
20	0.0271	16.9140	0.0539	4.6522	0.0234

Note: Based on 905 daily rates of return of large minus small index for March 20, 2003 to October 20 2006

Table 6.3

Holding Period (days)	Intercept	T-Statistics	Slope	T-Statistics	R^2
1	0.0002	0.3136	0.0048	1.5782	0.0028
2	0.0004	0.3634	0.0062	1.6414	0.0030
3	0.0005	0.4310	0.0060	1.3952	0.0022
4	0.0007	0.5221	0.0057	1.1693	0.0015
5	0.0004	0.3634	0.0062	1.6414	0.0030
10	0.0012	0.6812	-0.0064	-0.9641	0.0010
20	0.0017	0.7448	-0.0059	-0.6791	0.0005

Note: Based on 905 daily rates of return of large minus small index for October 20, 2006 to May 28, 2010

In this case we are following Copland and Copland's (1999) trading strategy again. When the MVX is X percent greater than its 75-day historical moving average, we will take a long position in our large-cap portfolio and a short position in our small-portfolio and meanwhile we do the opposite when the MVX drops below the X percent. The result of this trading strategy is in table 7.1, 7.2 and 7.3. We again separated the results into two sub-periods as previously mentioned. The Holding Periods column shows that the number of days a position is kept (position was often maintained from day to day) once it was signaled by a given percentage change of MVX (the second column). Column 3 shows the number of round trip transactions (a buy and a sell).

Table 7.1 is based on 1809 daily data for the period March 20th 2003 to May 28th 2010. The trading strategy based on size doesn't yield positive return consistently based on 95% confidence interval. We cannot conclude that any of the positive returns is a result of our trading strategy.

Table 7.1

Note: Based on 1809 daily rates of return of large minus small index for March 20, 2003 to May 28, 2010

Holding Period (Days)	Changes in the MVX	Number of Round-Trip Transactions	Cumulative Return	Daily Average Return (Basis Points)
1	10	62	30.41%	7.74
1	20	34	0.78%	0.37
1	30	25	0.68%	0.58
1	40	17	-1.20%	-1.72
1	-10	72	18.44%	3.50
1	-20	50	-9.96%	-5.36
2	10	38	9.83%	2.66
2	20	27	-14.08%	-6.97
2	30	15	-16.38%	-15.31
2	40	6	-19.55%	-33.13
2	-10	48	34.37%	6.83
2	-20	22	15.07%	9.53
3	10	25	-10.16%	-2.96
3	20	16	-16.90%	-9.39
3	30	9	-28.14%	-29.62
3	40	6	-19.55%	-33.13
3	-10	39	36.98%	7.62
3	-20	12	15.39%	11.15
10	10	13	-2.36%	-0.83
10	20	6	-23.49%	-18.07
10	30	2	-15.13%	-31.51
10	40	2	-20.66%	-52.96
10	-10	15	31.29%	9.07
10	-20	5	27.79%	27.52

Table 7.2, is based on 905 daily data from March 20th 2003 to October 20th 2006. It shows that the results are consistent for 10 % and 20% change in the MVX, but the only period that has a high t-statistics is for the 10 day holding period. So hence the timing by size strategy can only be used in the normal economic conditions for 10~20% changes in the MVX and for holding periods of 10 days only.

Table 7.2

Note: Based on 905 daily rates of return of large minus small index for March 20, 2003 to October 20 2006

Holding Period (Days)	Changes in the MVX	Number of Round-Trip Transactions	Cumulative Return	Daily Average Return (Basis Points)
1	10	23	36.29%	21.99
1	20	13	17.67%	26.37
1	30	6	3.57%	11.89
1	40	4	-0.44%	-5.46
1	-10	31	25.45%	13.25
1	-20	10	13.40%	29.13
2	10	13	30.14%	19.45
2	20	10	9.90%	15.46
2	30	5	3.42%	11.78
2	40	2	1.86%	30.95
2	-10	19	21.96%	12.20
2	-20	4	11.34%	28.36
3	10	10	24.10%	16.17
3	20	6	2.82%	5.03
3	30	2	-0.39%	-1.68
3	40	2	1.86%	30.95
3	-10	14	24.20%	14.23
3	-20	1	9.96%	29.29
10	10	6	26.24%	19.88
10	20	2	2.24%	6.40
10	30	1	1.13%	6.28
10	40	0	0.00%	0.00
10	-10	6	16.66%	12.53
10	-20	1	9.96%	29.29

Table 7.3 is based on 905 daily data from October 20th 2006 to May 28th 2010. The results are not significant as the cumulative return is inconsistent. As well, the t-statistics are low for regressions. We thereby conclude that timing by size doesn't yield positive results during financial crisis.

Table 7.3

Note: Based on 905 daily rates of return of large minus small index for October 20, 2006 to May 28, 2010

Holding Period (Days)	Changes in the MVX	Number of Round-Trip Transactions	Cumulative Return	Daily Average Return (Basis Points)
1	10	39	-5.88%	-2.58
1	20	21	-16.89%	-11.90
1	30	19	-2.89%	-3.32
1	40	13	-0.77%	-1.24
1	-10	41	-7.00%	-2.09
1	-20	40	-23.36%	-16.69
2	10	25	-20.32%	-9.49
2	20	17	-23.20%	-16.81
2	30	10	-19.80%	-25.38
2	40	4	-21.41%	-40.39
2	-10	29	12.41%	3.84
2	-20	18	3.72%	3.15
3	10	15	-34.26%	-17.66
3	20	10	-18.94%	-15.28
3	30	7	-27.75%	-38.54
3	40	4	-21.41%	-40.39
3	-10	25	12.78%	4.06
3	-20	11	5.43%	5.22
10	10	7	-28.60%	-17.88
10	20	4	-25.73%	-25.99
10	30	1	-16.26%	-54.19
10	40	2	-20.66%	-52.96
10	-10	9	14.63%	6.56
10	-20	4	17.83%	26.62

5: Conclusion

In this paper we used the one-day percentage changes in the MVX from its 75-day historical moving average as a signal for rotating between portfolios based on style (Value versus Growth) and size (Large versus Small), we came up with results that discussed earlier.

Strategy one is switching between value and growth portfolios. If the estimate of expected future volatility increases, we will take a long position in value portfolio and a short position in growth portfolio and vice versa. Strategy two is switching between the size of the companies in the portfolio. If the estimate of expected future volatility increases, we will take a long position in the large portfolio and a short position in small portfolio and vice versa.

In our paper where we used MVX to replace VIX and S&P/TSX to replace the S&P and NASDAQ the results are different. In the Canadian market, MVX is only a good timing indicator for the Rotating using style strategy. We didn't obtain explainable or robust results from the rotating using size strategy.

The Betas of the trading strategies based on style and size are relatively low which shows they are low risk strategies (table 2. and table 5.)

Unlike the Copeland and Copeland (1999) who had their portfolios constructed by an external vendor, we were not able to obtain the same information for the TSX. We used the measurements of Book Value per Share as well as Sales Growth per Share to identify the Value and Growth stocks respectively. The TSX's universe is extremely small in terms of number of stocks as well as the number of companies in individual sectors. It is extremely skewed towards the Financial and Energy sector. This could jeopardize apples to apples comparison to the American financial system. We think enhancements can be done to improve the portfolios by using Price to Book ratio or other combination of measurements as well figuring out a way to increase the compare the two countries result in a relative manner. We did explore other ratios such as P/B, Sales Growth, but we could not implement it with significant results for the regressions.

The second limitation that we faced is that although we were able to obtain very high t-statistics for the Large minus Small Index's Return Vs. the percentage change in the MVX (significant for one to five holding days), the returns from the trading strategies are mostly

negative or inconsistent. Our interpretation of this result is that the regression is valid but our trading strategy is not interrupting the regression correctly hence the negative return. A more in depth and complex issue would be interpreting the result of the regression and creating a positive return trading strategy.

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[i] http://www.m-x.ca/indicesmx_mvx_en.php
The Montréal Exchange introduces a new Implied Volatility Index (MVX) reflecting the market's expectation of how relatively volatile the stock market will be over the next month. MVX is calculated from current prices of at-the-money options on the iShares of the CDN S&P/TSX 60 Fund (XIU). MVX is an implied volatility index that is updated every minute of a trading day.

[ii] http://www.cboe.com/micro/vix/introduction.aspx
The CBOE Volatility Index® (VIX®) is a key measure of market expectations of near-term volatility conveyed by S&P 500 stock index option prices. Since its introduction in 1993, VIX has been considered by many to be the world's premier barometer of investor sentiment and market volatility.

[iii] http://tmx.quotemedia.com/quote.php?qm_symbol=^0000
[iv] The model is a generalized autoregressive conditional heteroskedasticity (GARCH, Bollerslev(1986)) model.
[v] The exponential general autoregressive conditional heteroskedastic (EGARCH) model by Nelson (1991) is another form of the GARCH mode
[vi] Data from Bloomberg Terminal

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